



## Press Release

# **E-cars: Particle accelerator proves that manufacturing is more sustainable with lasers with green wavelength**

**Collaboration between TRUMPF, Fraunhofer ILT and DESY provides the most detailed of insights into laser welding processes to date thanks to the particle accelerator // Fraunhofer expert Marc Hummel: "We have now been able to clearly prove for the first time that raw materials can be saved in the welding high-performance electronics by using lasers with green wavelength."**

*Ditzingen / Aachen / Hamburg, April 20, 2023* – Lots of raw materials can be saved in the welding of high-performance electronics. This is the result of an investigation at the German Electron Synchrotron DESY of the Helmholtz Association in Hamburg. High-performance electronics are in every e-car and, as a key technology, ensure the best performance of the battery and motor. The Hamburg researchers, together with the high-tech company TRUMPF and the Fraunhofer Institute for Laser Technology ILT, have now investigated the laser welding processes that are used in the manufacture of e-cars. TRUMPF, Fraunhofer ILT, DESY and the Helmholtz Center Hereon each contributed their highly specialized knowledge of X-rays, laser sources and welding processes. As a result, insights that remain invisible to the eye and even to microscopes have now been achieved for the first time. The result: When a laser with green wavelength is used, far fewer rejects are produced than with other laser welding processes. Car manufacturers save raw materials and thus contribute to more sustainable manufacturing.

### **Particle accelerator provides detailed insights**

The project partners used the brilliant X-rays of the particle accelerator at the Hereon experimental setup for their investigation to take high-speed images at several thousand to ten thousand frames per second. "We wanted to use the investigations at the particle accelerator to find out exactly what makes the difference in copper welding. A stable welding process is important because manufacturers of electric vehicles have to weld several billion connections of the highest quality," says Marc Hummel, a scientist at Fraunhofer ILT. In the future,



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TRUMPF and the Fraunhofer ILT plan to expand research to other areas such as 3D printing, laser cutting and laser drilling with ultrashort pulse lasers, and to bring other industry partners on board.

### **E-mobility: Fewer rejects thanks to lasers with green wavelength**

Electromobility poses major challenges for laser technology. Copper is the most important material for the manufacturing of core e-mobility components. This non-ferrous metal absorbs only about 5 percent of laser radiation in the near infrared range (NIR) and conducts heat very well. Both of these properties lead to considerable problems when welding. The processes are therefore under scrutiny. In addition to NIR lasers, TRUMPF also has lasers with green wavelength in its product range. "Lasers with green wavelength are the solution to this problem. In fact, copper can be welded better with these lasers," said Mauritz Möller, Automotive Industry Manager at TRUMPF. Copper absorbs the green wavelength much better than the infrared. Because the material thus reaches its melting temperature more quickly, the welding process also starts faster and less laser power is required. "More stable processes when welding mean fewer rejects and thus greater sustainability, which is a major issue in e-mobility," said Mauritz Möller.

### **Experiments at the particle accelerator**

To study welding processes in detail, experts from the Fraunhofer ILT, in collaboration with the Chair of Laser Technology LLT at RWTH Aachen University, use DESY's PETRA III X-ray light source on the experimental setup at the Helmholtz Center Hereon. "Conventional methods actually only see the electromagnetic emissions from the plasma. With DESY's radiation, we can not only look inside the melt, but we can even make the melt dynamics visible," explained Marc Hummel.

To do this, a team from Fraunhofer ILT and TRUMPF studied laser welding processes at DESY using two different laser systems: an NIR laser and a laser with green wavelength. "For us, this is a great opportunity to study welding processes on industrial parts. For example, how do spatters and pores form, and



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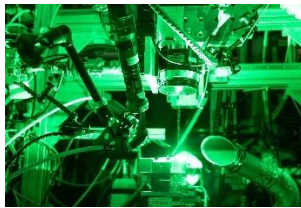
how does the heat from the welding process affect sensitive components such as electronic parts," said Mauritz Möller.

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### Research at the particle accelerator

TRUMPF and the Fraunhofer ILT conducted research on laser welding at a particle accelerator at the German Electron Synchrotron (DESY) in Hamburg.



### Investigation of laser welding processes

TRUMPF and the Fraunhofer ILT investigated the laser welding of copper connections in the high-performance electronics of e-cars at a particle accelerator at the German Electron Synchrotron (DESY) in Hamburg.



### Cooperation between TRUMPF and Fraunhofer

TRUMPF and the Fraunhofer ILT contributed their know-how for laser sources and welding processes for the experiments at the particle accelerator.



### About TRUMPF

TRUMPF is a high-tech company offering manufacturing solutions in the fields of machine tools and laser technology. The company drives digital connectivity in manufacturing through consulting, platform products and software. TRUMPF is a technology and market leader in highly versatile machine tools for sheet metal processing and in the field of industrial lasers.

In 2021/22, the company employed some 16,500 people and generated sales of about 4.2 billion euros. With over 80 subsidiaries, the TRUMPF Group is represented in nearly every European country as well as in North America, South America and Asia. The company has production facilities in Germany, France, the United Kingdom, Italy, Austria, Switzerland, Poland, the Czech Republic, the United States, Mexico and China.

Find out more about TRUMPF at [www.trumpf.com](http://www.trumpf.com)



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